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(54) METHOD OF IMPROVING THE KEEPING PROPERTIES OF ALCOHOLIC BEVERAGES PRODUCED BY FERMENTATION

(71) We, MESSER GRIESHEIM G.m.b.H., a Company organised under the laws of Germany, of Frankfurt/Main, Hanauer Landstr. 300, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to the improvement of the keeping properties of beverages, particularly although not exclusively beers, by the use of inert gases in the production, bottling, and storage of these beverages.

Owing to longer storage times and time taken during exportation, increasingly high demands have recently been made in respect of keeping properties of beverages. In the presence of oxygen, usually atmospheric oxygen, material changes occur in the beverages which greatly impair their technological and taste properties.

It is therefore important to prevent access of oxygen to the beverages, as far as possible. Manufacture of the beverages, including after-fermentation, decanting, storage, and bottling should therefore take place in an inert gas atmosphere, with the exclusion of oxygen. The empty space remaining in storage vessels after filling with a beverage should also be filled with inert gas.

Carbon dioxide (CO_2) was hitherto mainly used as inert gas for this purpose. Carbon dioxide is produced, among other ways, by alcoholic fermentation. The amounts of carbon dioxide produced are sufficient to meet the internal requirements of breweries, but it is, however, difficult for the carbon dioxide needed for later operations, such as for example bottling, to be produced with the necessary purity from the fermentation products. In addition, this process entails considerable capital expense for closed fermentation vats, piping, compressors, storage and pressure vessels, etc. For this reason, part of the carbon dioxide is purchased from gas supplies.

Carbon dioxide is dissolved in the finished beer (in larger or smaller amounts depending on the pressure). If the pressure were to be lowered, some of the carbon dioxide dissolved would be liberated. All decantation and filling operations must therefore be carried out at a higher pressure than the pressure of saturation.

In order to maintain required pressure in the tanks or selling vessels, an inert gas should be used in all cases, in order to avoid oxidation.

The present invention is based on the observation that nitrogen or argon or other inert gases in Group O of the Periodic Table are particularly suitable for this purpose.

The present invention therefore provides a method of improving the keeping properties of alcohol beverages produced by fermentation, which comprises effecting the main fermentation, and then carrying out after-fermentation of the alcoholic beverages and any after-treatment (as hereinbefore defined) in an atmosphere of an inert gas selected from: nitrogen and the rare gases of group O of the Periodic Table.

By "after-treatment" of the beverages is meant decanting, and if desired, bottling and storing the beverages, in an inert gas atmosphere, after the fermentation. Nitrogen is preferably used as inert gas, but rare gases such as argon and the other inert gases in Group O of the Periodic Table are also used.

The use of nitrogen is above all, very economical.

In order to avoid loss of carbon dioxide, the conditions of equilibrium adjusted during the after-fermentation of the alcohol beverages should not be changed. This means that during filtering, decanting or bottling and during storage of the beverages a minimum pressure must always be applied to the liquid. Thus, for example, the pressure tanks and, in the case of fully automatic filling machines, the cleaned empty bottles, should

preferably first be pre-pressurised with gas. It has now been found particularly advantageous that this pre-pressurising should be effected with an inert gas, for example nitrogen. If the bottles are, in addition, evacuated before the pre-pressurising, particularly favourable results are obtained since the oxygen, which is detrimental to storage, is then almost completely removed. The beverages can then be kept for a particularly long period of time.

In order to illustrate clearly the process of the invention, various series of tests were carried out with beer as alcoholic beverage. The suitability of the process was clearly provide by cold stability measurements, shaking tests, and oxygen content measurements.

In the first series of tests, the bottling of beer by means of an automatic bottling machine was carried out under various conditions. The conditions used in the various series of tests were as follows:

1. First series of tests: Storage or pressure tanks were pre-pressurised with nitrogen, filled with beer under pressure, and the beer was subsequently forced and emptied under pressure, with the aid of nitrogen, to the bottling machines. The bottles were pre-pressurised, likewise with nitrogen, after pre-evacuation to the extent of 98% of their volume (i.e. the bottles are evacuated to 2% of their original air content).

2. Second series of tests: Pre-pressurisation of the tank was carried out as in the first series of tests. The pre-pressurisation of the bottles was effected with nitrogen, but without pre-evacuation.

3. Third series of tests: The tanks were filled with beer under pressure without pre-pressurisation of the tanks with inert gas, and subsequently the beer was forced, by means of nitrogen, to the bottling machine. Before filling, the bottles were evacuated and pre-pressurised with nitrogen.

4. Fourth series of tests: Normally pre-treated beer was bottled with the aid of compressed air.

Nitrogen was supplied from a storage vessel containing liquid nitrogen. The latter was stored in a cold gasifier and transported to the consumption points via a pressure regulator, automatically adjusting a gauge pressure of 5 atmospheres nitrogen.

After bottling in accordance with the conditions indicated, the beer was subjected to a cold stabilisation test and a shaking test.

In the test for cold stability, the beer was in each case kept alternately for 24 hours at +24°C and 24 hours at 0°C and turbidity was measured. A cycle of 48 hours is referred to as a 'heat day'.

In the shaking test, the beer was shaken in a storage cellar at —1°C, and the shaking time before the occurrence of turbidity was measured. The degree of turbidity is measured in EBC units in a haze meter (European Brewery Convention). The scale extends from 0 to 12, and turbidity rises with increasing EBC value. The measurements are shown in the Tables in Figures 1 and 2.

The table values clearly show that the best keeping properties of the beer were obtained by using the process of the first series of tests, that is to say, when carrying out the method according to the invention. The poorest keeping properties occurred with the process of the fourth series of tests, which is the usual process employed at present in the art. The oxygen content of a bottle from the first series of tests amounted to 0.1 mg, and that of a bottle from the fourth series of tests to 0.4 mg.

The supply of nitrogen for the process of the invention may be obtained from ordinary commercially available cold gasifiers, which can be refilled after use. The nitrogen is converted from the liquid state to the gaseous state by means of air-heated evaporators. Using ordinary pressure regulators, it is possible for inert gas pressures of up to 20 atmospheres gauge to be adjusted automatically.

WHAT WE CLAIM IS:—

1. A method of improving the keeping properties of alcoholic beverages produced by fermentation, which comprises effecting the main fermentation, and then carrying out after-fermentation of the alcoholic beverages and any after-treatment (as hereinbefore defined) in an atmosphere of an inert gas selected from: nitrogen and the rare gases of group O of the Periodic Table.

2. A method as claimed in claim 1, wherein the rare gas used is argon.

3. A method as claimed in claim 1 or 2, wherein the alcoholic beverage is a beer.

4. A method as claimed in any one of claims 1 to 3, wherein during the after-fermentation, decanting, filling into containers and also during storage, the alcoholic beverages are subjected to a superatmospheric pressure by the inert gas.

5. A method as claimed in any one of claims 1, 3 or 4, wherein nitrogen is used as inert gas and is supplied from a storage vessel for liquid nitrogen by way of a gasifier and a pressure regulator to the beverage containers, or to the piping system of a bottling plant where the beverage is bottled.

6. A method as claimed in claim 1, and

substantially as described herein with reference to the accompanying drawings.

7. Alcoholic beverages produced by fermentation and having improved keeping properties, whenever treated by the method claimed in any one of claims 1 to 6.

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Fig. 1

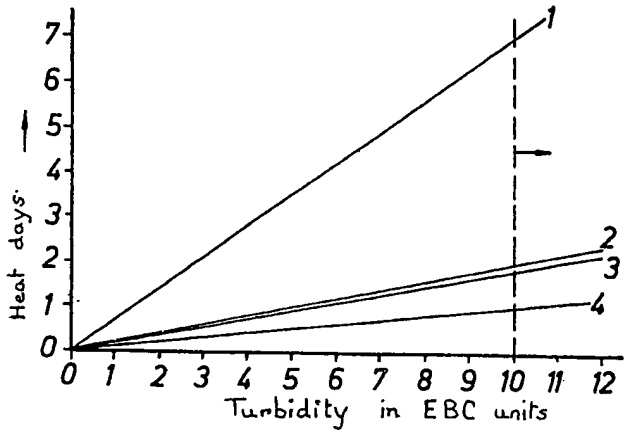
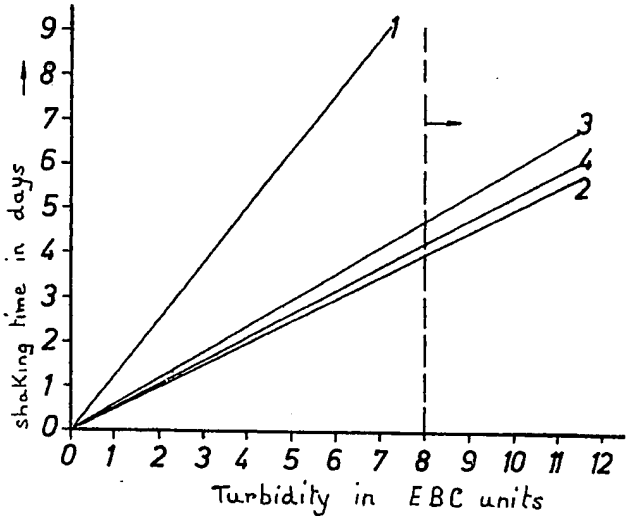

Heat days
0 1 2 3 4 5 6 7
0 1 2 3 4 5 6 7 8 9 10 11 12
Turbidity in EBC units
1
2
3
4

Fig. 2


shaking time in days
0 1 2 3 4 5 6 7 8 9
0 1 2 3 4 5 6 7 8 9 10 11 12
Turbidity in EBC units
1
2
3
4